DOCUMENT RESUME

ED 062 375 TM 001 309

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TITLE The Meaning and Measurement of Creativity in Education.
PUB DATE 71
NOTE 54p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Cognitive Processes; Creative Ability; *Creative Thinking; Creativity; *Creativity Tests; Measurement Instruments; *Models; Personality Assessment; *Psychological Characteristics; Standardized Tests; *Thought Processes

ABSTRACT

An attempt is made to formulate, develop, and test principles for: (1) creating an environment which places high value on creativity; (2) guiding the evaluative behavior of teachers, counselors, and administrators; and (3) helping children develop evaluative behavior conducive to creative thinking. (Author/DB)

ED 062375

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Fall Semester, 1971

THE MEANING AND MEASUREMENT OF CREATIVITY IN EDUCATION

TM 001 309

COLLEGE OF EDUCATION

ARIZONA STATE UNIVERSITY

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1. Introduction:

Creativity seems to appear with Galton (1869)[1] No accepted definition of creativity exists but it is classified into a variety of categories, depending upon the particular author, for example: Torrance's diverse definition includes the "Four P's of Creativity" (Person, Process, Press, and Products), Person meaning a phenomena by which a person communicates a new concept or Product, Process meaning mental activity, and Press meaning environment.[2] Gruber, Terrill, and Wertheimer limit the categories of creativity to the Extraordinary, the Process, and the Product.[3] Stein hypothesizes that creative persons may reveal a sensitivity to the gaps existing in his culture, in addition to tolerance of ambiguity, and ability to maintain direction as hypotheses are tested and refined.[4] Stewart[5] and Thurstone[6] point to the fact that "productive" thinking can be in the mind of the humblest workman as well as the most distinguished statesmnn;[7] however, the working man's "every day creativity" may endanger our concept of creativity, or "great man theory," as meaningless.[8] Since this report focuses on the relationship of creativity to education, it would seem that the "small man theory" is superfluous to our topic. Guilford finalizes this introduction by his conceptualization of creative thinking as inextricably involved with divergent production (i.e., a variety of output from the same source, reflecting the use of innovation, originality, and unusual synthesis);[9] however, he doesn't equate "creative" thinking with "divergent" thinking which is reflected in fluency, flexibility, originality and elaboration because of two factors important to creative thinking: (1) continuous redefinition of abilities involving transformations of thought, reinterpretations, and freedom from functional fixedness in deriving unique solutions, and (2) sensitivity to problems which seem to be THE basis in getting the creative thinking process in motion.[10]

2. Statement and Purpose of Problem:

a. The problem is: What is the definition and measurement of creativity? The "purpose of this report" is to attempt to formulate, develop, and test

principles for (1) creating an environment which places high value on creativity; (2) guiding the evaluative behavior of teachers, counselors, and administrators; and (3) helping children develop evaluative behavior conducive to creative thinking.[11]

3. Definition of Terms:

a. There is no universally agreed-upon definition of creativity, any more than there is of intelligence. In general, the most widely applied concepts of creativity must be classified according to categories, essentially depending on the emphasis given to Process, Experience (environment or Press), and Product.[12] None of the preceding concepts of creativity is immune from the objection that each omits some characteristic vital to the others. This is a disadvantage because of their having no unifying rationale.[13] Interestingly, the more widely held concepts of creativity are derived from diverse sources of logic, philosophy, learning theory, Gestalt phychology (which emphasizes the structure of related experiences instead of the summing of bits of experience[14]), and psychoanalysis (whereby abnormal mental reactions are caused by repressed desires existing in the subconscious[15]).[16]

b. Psychologists undertake to study highly creative persons with hope of discovering what it is that makes them stand out; no American psychologist has faced this problem so directly as Gordon W. Allport who repeatedly emphasizes that the outstanding characteristic of man is his individuality.[17] We can state that three different viewpoints exist as to study of creativity in outstanding people, namely:[18] (1) the Max Meyer - Watsonian approach which decrees that a disrription of one individual without reference to others is literature, not science; (2) the Wilhelm Dilthey - Edward Spranger approach decrees that descriptive psychology emphasizing understanding of the individual and analytical psychology emphasizing the generalities of an individual is scientifically valid; (3) the Allport-Kuckholn - Murray

approach attempts to reconcile the previous two viewpoints using the rationale that the distinction between individuality and general SOCIETAL lawfulness has been drawn too sharply. This third approach points out that everyone is in certain respects (1) like all other men, (2) like some other men, and (3) like no other man.

c. Some authorities maintain that all external evaluation should be absent from an environment (Press) so that successful creative behavior occurs; others insist that all negative evaluation be made taboo; finally, others emphasize the importance of using positive and negative evaluation in order to stimulate and develop creative thinking.

d. Since creativity varies in degree and in kind, <u>essential continuity in creativity</u> is found in Process, not in the Product. With this assumption primarily in the minds of six eminent scientists gathered for a symposium at the University of Colorado in 1958, the following participants stated their individual approach to the above assumption:[19]

(1) Jerome S. Bruner of Harvard believed a team of inventors carry on their creative work in the form of group discussions. Essentially, he was emphasizing the externalizing of behavior.

(2) Mary Henle of the New School for Social Research in New York City focused upon PERSONAL internal discussion reflecting the perpetually turbulent nature of the inner struggle that marks the course of creative effort.

(3) David C. McClelland of Harvard focused upon the blending of commitment and detachment in Process.

(4) Richard S. Crutchfield of the University of California examined the relationship between conformity and creative thinking.

(5) Herbert S. Simon of the Carnegie Institute of Technology was preoccupied with designing computer programs which would yield new levels of precision in simulation in order to attempt description of creative human problem-solving behaviors.

(6) Robert B. MacLeod of Cornell was similarly occupied with computer simulation but his emphasis was on Logic Theorists and Chess Players.

e. Conditions of Creativity:

Jerome S. Bruner states several, namely:[20]

(1) Detachment and Commitment - A willingness to divorce oneself from the obvious as a prerequisite that produces an effective surprise; but this is a detachment of commitment.

(2) Passion and Decorum - A passion to willingly let one's impulses express themselves through one's work; however, an etiquette must be maintained toward the object of our efforts.

(3) Freedom to be Dominated by the Object - You began to write a poem, for example; soon the writer is serving the poem.

(4) Deferral and Immediacy - For example, there is an immediacy to create a thing or general idea but counter pressures attempt to prevent completion.

(5) Internal Drama - Man can play many roles; these roles are the source of the richest and most surprising combinations beneficial to creative thought

4. Significance of Problem: Is that children and people learn along the lines they consider rewarding and that creative thinking is rewarding.[21]

5. Work Plan:

An attempt is made to review present definitions and measurements of creativity in education; a minor part of this exploration will be historical and social in nature; the major part will be experimental because readings indicate that education research is disatisfied with the descriptive approach.

6. Review of Literature:

There are levels of creativity, namely: independent expression; artistic or scientific products; inventiveness and modification of conceptualizing skills.[22] At the basis of these creative levels are strong human needs. If the person senses incompleteness, it is felt as resulting in tension which is sought to be relieved.[23] Among educators creative thinking is either threatening or a force to be encouraged for

lifting the student to higher levels of intellectual functioning. Interestingly, as Torrance accumulated RESEARCH, it became clear that creative thinking is important in mental health, educational achievement, vocational success, and many other important areas of life.[29] Of course, some educationalists say it leads to a troubled classroom; much undesirable behavior shouldn't be allowed (but if channeled and guided may lead to socially valued achievements).[25]

A.

Why should creative thinking be rewarded? Vigorous creative imaginations which survive early stifling may become dangerous to society, if they learn to act vigorously without guidance. A reply to this statement might be that children's creative efforts left unnoticed feel rejected and loose confidence to create.[26] Torrance elaborates by stating the creative person whose ideas are ignored or rejected should be protected until he can work them out and make them productive. This was found true not only in children but in a study of creative engineers.[27] In short, some educators would reward creative behavior because they see in it a powerful motivation for learning. To further elaborate, there is a periodical need when a person can learn without threats of immediate evaluation, especially in the learning of new skills and in creative activities. External evaluation creates defensiveness, producing a lack of openness necessary for creative thinking.[28] Besides having a need to reduce defensiveness, a person needs anchors with his environment to maintain contact with it and to determine his limits of abilities. The personal experiences of others are insufficient.[29]

Handlin (1962) believes current evaluation systems encourage memory, accuracy, neatness, and cautiousness, but rarely call upon students to excercise their ability independently or speculatively for a problem in which answers are to be discovered;[30] Handlin further states that only the reckless would dare not to know the right answer (as the grader expects) or dare allow THEIR questions to draw the classes' thinking in unexpected ways.[31]

The Overstreets (1954) view rewarding of creative thinking as a counter-

force which discourages self-initiated learning through ill-placed humor, irritation, or evasiveness; when the child reaches the point of tolerance too painful REGARDING educational methodology where BY his nervous system, interests, and abilities can't endure, he gives up trying and begins to fail.[32] Ojemann (1961) has a belief, based on his research, that lack of rewarding creative thinking is caused by a general lack of educationalists to appreciate individual indifferences.[33]

Unfortunately, in many educational circles, creativity is perceived as a threat by authorities. This statement is reinforced by others, namely: (1) Toynbee (1962) who emphasizes that an incorrect view of Democracy forces to neutralize outstanding ability and also forces to emphasize vested interests;[34] and (2) Pepinsky (1959) who states that a group will tolerate a "few" creative individuals, even rewarding a few; but the number tolerated and rewarded depends upon the extent to which the creative minority constitutes a disturbing challenge to entrenched beliefs, vested interests, "duly constituted" authority, and the accepted "way of life."[35]

To summarize, some believe that it is necessary for all educators from kindergarten thorugh graduate school to be alert to new ideas and to encourage those who produce new ideas to make the most of their abilities; however, some types of so-called creative thinking should be regarded with alarm because it is this kind which is based upon false premises, distortions of truth, and failure to test hypotheses.[36]

B.

A strategy of evaluation of creative thinking can take on three aspects: (1) societal's (environmental's) view of creative thinking; (2) external evaluation by peers, parents and teachers; and (3) personal (or internal) evaluation of the creative individual.[37] In a hostile evaluative environment towards creative thinking, a person soon learns to not express creative ideas; the slowness which investigators have been willing to study creative behavior may reflect the value society has put upon it,[38] since creative thinking, the highest of mental functions, reflected in creative production and in the highest of human achievements, has been a serious research study for only 12 years.[39] In 1950 only 186 books or articles

on creativity were written, but by 1965, the Psychological Abstracts listed 132 items in one year.[40]

External evaluation by parents, peers, and one's teacher reflects that creative behavior is unlikely to flower in a hostile or indifferent environment.[41] Guilford in 1950 calls attention to education's neglect of creativity; Osborn in 1948 [42] not only reinforces Guilford's opinion but continues to do so in a recent book (1957) and in the activities of the Creative Education Foundation.[43]

Many investigators have attempted to show that by making whole areas taboo, a culture inhibits creative potential (Murphy 1958, Rogers, 1954); their view of educational life certainly doesn't exclude student discipline.[44] Mead's (1959) view doesn't consider an isolated creative person as advantageous to team efforts where creative achievements of the future exist.[45] The Getzels' (1960) challenged the criteria used in college admissions (tests, recommendations, and class rank) because their research expressed that the admission procedures were biased in favor of student "convergent" intellectual ability and social interests; even though students with superior "divergent" intellectual ability "in the long run" would deserve a scholastic position equal to the superior convergent student.[46] Holland and Kent (1960) emphasized the fact that the National Merit Scholarship Corporation has begun to recognize scholarships may be going to the wrong people.[47]

> Later, this organization established a program for giving scholarships to two categories of students who would not otherwise have been awarded such financial aid: (a) students with high creative promise and (b) students who are truly outstanding in some field but less outstanding in others. Follow-up studies of these awards will test the wisdom of this practice.[48]

Finally, Wylie (1963) hypothesizes a relationship between creative thinking and self-concept; essentially, he concludes that the INTELLECTUAL needs of the culturally deprived child do not receive respect; thus societal deprecation of certain categories of people (women, Negroes, and the culturally deprived) may be causing

us to loose much creative talent[49] (necessary for national survival).

What facts can the teachers consider to elevate the encouragement of creative thinking? Hyman (1960) found significant increase in unique responses when "creative" instructions were given to engineers as compared to the ideas they produced under "practical" instructions.[50] Datta (1963) found that neutral instructions given in tests of creative thinking may decrease the power of the tests to discriminate among the more or less creative individuals; in short, the creative individuals inhibit their creative thinking because they fear their original ideas won't be acceptable.[51] Another point, erroneous evaluations of a student causes an erroneous attitude toward the student's abilities and skills, for example: A student whose IQ and class room number were transposed on his cumulative record resulted in teachers and counselors treating him as though he was retarded, although his IQ was 140.[52] Fortunately, the student found positive evaluation outside of school and continued to learn as shown by outstanding scores on the science and mathematics College Board Exams and by eight major awards at a national, state, and regional level for creative achievement in science; his school grades continued to be poor and his peers continued to regard him as a "dumbell."[53] Mearns (1941) found that when a student is convinced that the teacher is not trying to reform him, the student is able to open up creatively through enjoying and sharing class productions and through offering truthful observations and deductions beyond his years of experience.[54]

> Generally, it has been thought that teachers should provide a stimulating environment to elicit creative thinking. This concept is compatible with the stimulus-response theory of learning.[55]

C.

Guilford thinks that psychology was poorly prepared to meet the needs of a changing world regarding stepped-up military invention, boredom associated with greater individual leisure, and changes on a technological, communicative, travel, and population plane because of psychology's general preoccupation with the Skinnerian stimulus-response model (where higher thought processes were disregarded,

resulting in a lack of creative thinking which only functions in the realm of the more abstract) and with the Hullian intervening- variable concept model.[56] In a 1959 interdisciplinary symposium on creativity at Michigan State University, Guilford proposed a psychological "trait" concept approach to creative thinking; traits are individual characteristics that can be used to emphasize common individual qualities or individual differences.[57] A "dependable" trait is one which is used to describe how a person functions. It is discoverable by factor analysis through the use of the computer, thus relieving educators from the bondage of classical designs,[58] enabling the researcher to further describe an individual's basic pattern of functioning through "primary" traits and to the placing of aptitudes for creativity within a general intellectual framework with special emphasis upon the evaluation of creative performance in everyday SCHOOL life experiences.[59]

Much interest, as a result of Guilford's research, has established an issue and also interest toward his classification of "primary" traits related to creativity, namely:[60]

(1) evaluative abilities - This trait is best indicated by stating problems created by objects or actions; essentially it is judgement that things aren't all right because goals haven't been reached.

(2) fluency:

(a) in thinking - This trait deals with the fertility of ideas.

(b) in word - This trait has much importance in science and art students whereby an ability exists to produce words each containing a specific letter or combination of words.

(c) in association - This trait requires the individual to produce as many synonyms for a given word during a time limit.

(d) in expression - This trait requires the rapid placing of side by side of words which meet the requirements of sentence structure. Interestingly, there is reasonable assumption of a correlation between corresponding performances in writing and in oral speech.

(e) in ideas - This trait requires the individual to produce ideas to fulfill test requirements in limited time.

(f) in spontaneity - It was a trait defined as the ability to produce a variety of ideas with freedom from inertia; rigid thinkers tend to stay within one or two categories of response.

(g) in adaptativity - This trait facilitates the solutions of problems and shows itself in a problem requiring an unusual solution.

(3) originality:

(a) in unusual responses - It is indicated by tests calling for remote associations or relationships.

(b) the unusual response trait is also indicated by the test scores in which keyed responses are weighted in proportion to their infrequency of occurrence in the population of the examinees.

(c) lastly, the unusual response trait is indicated in test responses which are rated as clever. The number of not-clever responses indicates educational fluency; but the number of clever responses indicates originality.

(4) elaboration:

(a) It is indicated when the examinee is given one or two simple lines and told to construct on this foundation a more complex object. For example, an examinee is given a bare outline of a plan; he is expected to list all minor steps needed to make the plan work.

The above classification of traits do not deny that motivation and temperament have significant determining effects upon creative performance.[61] Roe (1946,1953) found that a willingness to work hard and to work long hours was the one common denominator that contributed to achievement and eminence in any field; however, there was no indication that it had a unique relation to creativity.[62]

So far, we have read research studies of traits which predisposes an individual not to perform in the usual manner. Since research only touches on such literature, it seems compelling to indicate at least three "primary" traits in different kinds of thinking, namely: reflective, rigorous, and artistic thinking.[63] The question

being raised is whether the three traits are related to thinking performances of various kinds;[64] however, the fact that all relationships of traits to creative thinking were studied in the context of psychological testing with motivation generally at a high pitch when taking tests, examinees have less room for showing strong relationships between test performance and nonaptitude traits (perhaps daily life experiences might possess creative thinking more strongly related to the multitudinous traits of motivation and temperament).[65] A final conclusion about traits is deemed necessary because of a recent factor- analysis of thinking interests revealing several variables by Guilford and Christensen (1957) related to creativity, namely:[66]

(1) tolerance of ambiguity - It is a willingness to accept some uncertainty in conclusions and decisions.

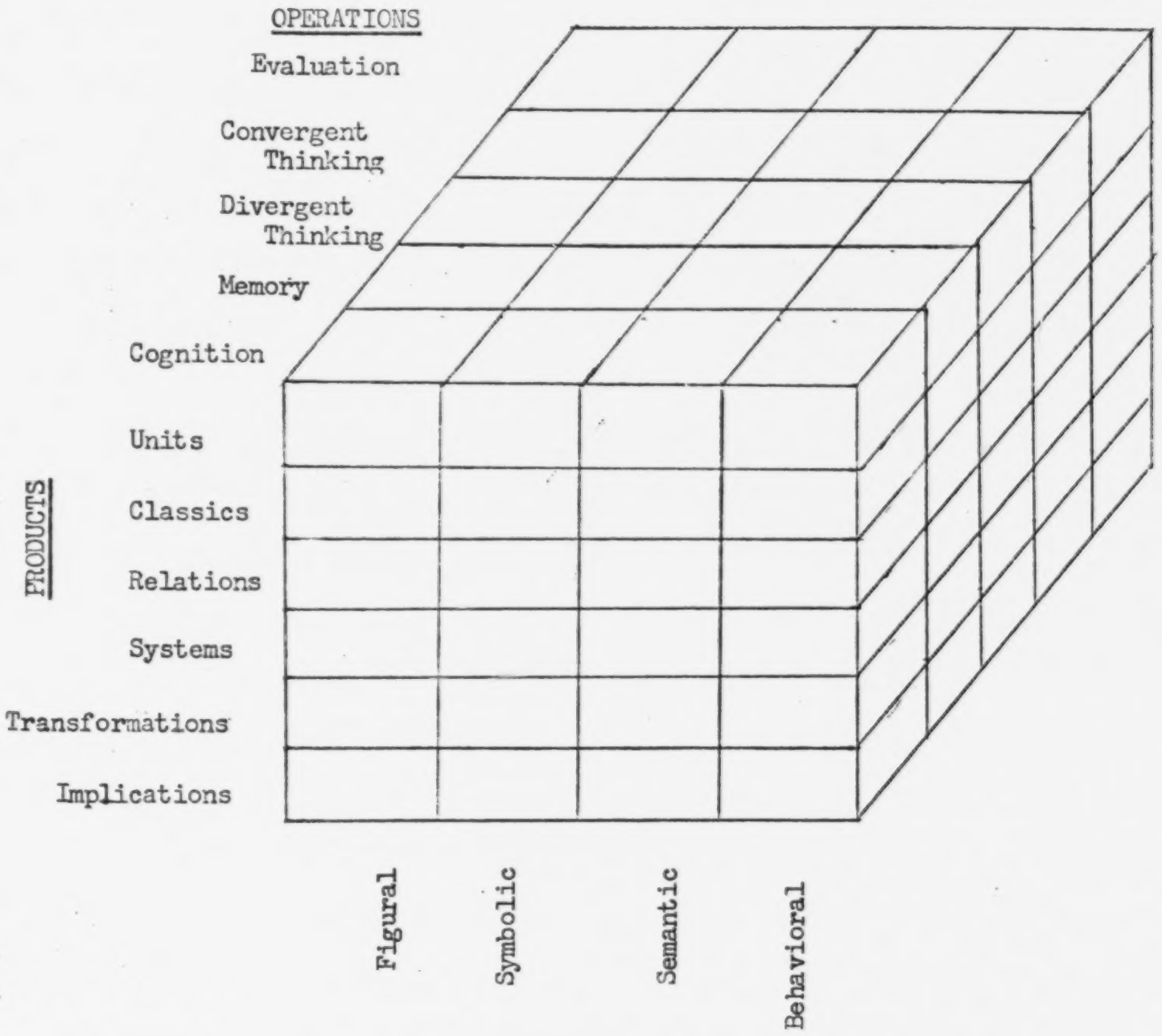
(2) convergent thinking - It involves thinking toward one right answer.

(3) divergent thinking - It involves thinking in which considerable searching about is done and a number of answers will do.

Guilford made several conclusions from his study on traits, namely:[67] that individuals who score high in "associational" fluency have a strong need for adventure and are more tolerant of ambiguity; that individuals having high test scores in ideational fluency are inclined to be more impulsive, authoritative, more confident, and have a stronger appreciation of creativity; that nervous individuals are low in tasks requiring ideational fluency but show no handicaps on other types of fluency tests; that individuals scoring high in expressional fluency are inclined to be more impulsive, to appreciate aesthetic expression, and to enjoy reflective thinking.

Guilford concludes that the relationship between creativity and intelligence always initiated interest because intelligence has never been uniquely defined.[68] (therefore the relationship has been ambiguous). Since there are fourty seven factors of intellect, he suggested a comprehensive theory of intellect by a geometrical diagram to illustrate that intelligence can be concrete, symbolic, and semantic when supported by one or more of the factors mentioned above[69] (interestingly, in 1927, Thorndike had already differentiated between social, abstract and mechanical

intelligence[79]. The following three-dimensional diagram represents an attempt to clarify Guilford's theory which will be followed by a succinct explanation.



The diagram is three dimensional only because of the common categories of materials, operations, and products which are the range of intellectual abilities; an examination of the fourty seven intellectual factors demonstrates that their properties can be put into a three-way classification. This three-way classification

is achieved by three major principles.[71]

The first major principle of classification specifies that "materials" (thought content), can be put into a three way classification. The materials are as follows:[72]

(1) figural - It is a form of an object perceived.

(2) visual - This aspect emphasizes the lines, shapes, color and texture of the form perceived.

(3) auditory - This aspect of thought content emphasizes the rhythms, melodies, and speech sounds of the form.

(4) tactual and kinesthetic thought content has, of yet, not been factor-analyzed.

(5) material can be called semantic (or conceptual); the best-recognized tests of intelligence have been composed of verbal meanings.

(6) a class of abilities, based on research of aptitudes, is called symbolic material. Examples are numbers, syllables, words, and code material.

The second major principle of classification pertains to the kind of "operations" performed upon the "materials"; there are five "recognized" kinds of operations which apply to each of the kind of the materials.[73] The kinds of operations in question are:[74]

(1) cognitions - These also are differentiated by kind. These factors pertain to rediscovering and recognition of things derived from them, recognition of figural and symbolic objects, and also meanings.

(2) memory abilities - There seems to be a different memory ability parallel to each cognition ability.

(3) convergent thinking - It proceeds toward a restricted problem solution.

(4) divergent thinking - It consists at being satisfied with several possible hypotheses so that a number of solutions to a problem will do.

(5) evaluation - It pertains to making evaluations of information derived from given information. In short, cognition and memory of past problem solutions are used to decide whether the present problem solution is correct or suitable.

Consequently, when we apply certain operations to certain kinds of materials, we come out with products of various kinds.[75]

The third major principle of classifying intellectual abilities is according to the product involved; the product may be a unit of thought (as a figure, a symbolic structure, or a concept); it may be a pattern, a system, or a gestalt of some kind, composed of units.[76] It could also be an implication as when we make a prediction from the information that is available. In short, each of these kinds of product as units, classes, relations, systems, and implications has its own primary abilities; although, IT IS NOT CERTAIN THAT ALL FIVE CLASSES OF PRODUCTS APPLY TO ALL KINDS OF MATERIAL COMBINED WITH ALL KINDS OF OPERATIONS.[77]

THUS IT APPEARS THAT EACH PRIMARY, INTELLECTUAL ABILITY REPRESENTS A KIND OF CROSSROAD OR INTERSECTION OF A CERTAIN KIND OF OPERATION, APPLIED TO A CERTAIN KIND OF MATERIAL, YIELDING A CERTAIN KIND OF PRODUCT.[78]

To conclude, other abilities, outside of the divergent thinking, make their contributions to productive thinking; arbitrarily, however, we can equate creative thinking to divergent thinking.[79]

Since creative thinking consists of many abilities ("originality" being only one), an IQ test which measures only three abilities of the thinking process (i.e., cognition, memory, and convergent thinking)[80] seems obsolete, simplistic, and a good rationale for continuing research in an attempt to identify the qualities of the creative process. Opposition, for example, to what has been said in this paragraph would seem to arise from scholars whose "framework of reference" allows for circular definitions (i.e., concepts which can't be operationally defined and which don't generate experimentation because of certain scholars' refusal to accept the Law of Parsimony) and don't allow for Guilford's multidimensional paradigm pertaining to the "Structure of Intellect" which has at least 60 identifiable thought process[81] and which was the major outcome of the work on the Aptitudes Research Project emphasizing factor-analysis investigations of human intellectual abilities in 1949.[82]

It would be convenient to conclude "external evaluation" of creative thinking, here and now, leaving the reader with the impression that everything pertaining to this topic is validated and reliable; unfortunately, since reliability and validity must be determined anew for each instrument,[83] considerable refining and validating of scales by systematic observation, experimentation, and personality studies are still in order, thus warranting further research.[84] APPENDIX A, interestingly, is a list of commercially obtainable tests for the identification of creative thinking, a prodigious task well worth a graduate student's attention. Three examples are as follows:[85]

(1) A-C Test of Creative Ability by D.H. Harris and A.L. Simberg has a scoring rationale based on the assumption that creative individuals produce higher quantities of quality, unique ideas when required to write consequences of a described situation. Available from Education-Industry Service, 1225 E. 60th. St., Chicago, Illinois 60637.

(2) Alternate Uses (AU), by P.R. Peterson, J.P. Guildord, P.R. Merrifield, and R.C. Wilson, tests the ability to produce a variety of class ideas in connection with an object or other unit of thought; it is used in jr. high schools through college and adult levels and it is available from the Sheridan Psychological Service, Inc., P.O. Box 837, Beverly Hills, California 90213.

(3) Creativity Test (form H), by C.H. Lwshe and D.H. Harris, is a twenty item test to determine fluency, flexibility, and originality. Available from Purdue University. Occupational Research Center, Layfallete, Indiana, 47907.

The "Minnesota Tests for Creative Thinking" is a monumental work comprising a battery of tests which identify outstanding children who differ meaningfully from their classmates of the same sex and of equal age as measured by intelligence tests such as the Standford-Binet, the Kuhlmann-Anderson Intelligence Test, the California Test of Mental Maturity, and The Otis Quick- scoring Mental Ability Test.[87] The work of the highly creative children compared with their equally intelligent classmates was

characterized by humor, playfulness, lack of rigidity, and relaxation;[88] however, the products produced outside of the test situation by the highly creative were rated as more original;[89] the highly creative, interestingly, had reputations among their peers and teachers as having wild or silly ideas.[90] Coefficients of correlation with traditional measures of intelligence were not statistically significant; yet, after the effects of mental age were discounted, there was statistical significance between standardized measures of achievement.[91]

Personal student evaluation involves self-evaluation skills,[92] namely: (1) self-confidence (i.e., self-concept) of which (Rogers, 1951; Maslow, 1954; Murphy,1961) have given great importance as a determinant of behavior; however, interestingly, there is little empirical evidence outside the clinical field to indicate a relationship between self-concept and creative functioning.[93] Professor V.H. Baumann, however, did remark in his class that his greatest difficulty in attempting to raise the average undergraduates' educational potential was the students' lack of appropriate self-concept.[94] (2) development of self-concept as it is related to creative thinking is a continuous process so that the student shouldn't expect an earth shaking experience to correct concept of self.[95] It should be emphasized, however, that a critical stage for immature youths and adults is when they recognize their personal separateness (i.e., believing that other people do not think as they do and that they are willing to trust their own perceiving and not depend completely upon someone else).[96] (3) allow one's self to express creative activities in order to clarify and develop self-concepts as related to one's creative functioning, thus giving value to the expressed idea.[97] (4) the findings of Julian and Steiner (1961) indicate that high group acceptance is related to high conformity, however, in groups where one member's success is unrelated to the success of other members.[98] These and other findings suggest the importance of studying social influences on creative thinking.[99] (5) the freedom to engage in self-initiated learning (Goertzels, 1962) Buhl, 1961).[100] This point was particularly evident in the study of creative behavior on eminent personalities, including creative engineers.[101] (6) cultural deprivation damages the

self-concept because of a small repertoire of societal graces making it impossible for individuals in this category to be "well rounded" which society so much adores (Riessman (1962).[102] (7) the observing of "feedback" from group participants which are cues to encourage or discourage certain behavior regarding the facilitation of learning and of creativity[103] (i.e., a student, who survives and succeeds with the traditional methodology of lecture and rote memory, finds himself unable to actively learn on his own, to think, and to solve problems.[104]).

D.

Behavioristic psychology recognized that creativity and originality are widely discussed topics as the hope for future man.[105] Wilbert S. Ray, for example, contributes his share of behavioristic research by concurring with Skinner and Hull that enough laboratory based material on creativity and originality exists so that he can publish a book in the area of educational creativity.[106] Neither Ray nor Maltzman equate creativity with originality, resulting in a book which essentially evaluates and tests originality;[107] Ray admits that a great many more behavioral and societal variables influence creativity but he uses this statement to reinforce the feasibility that his study should be channeled toward originality.[108]

Guilford (1959) concurs with Ray and Maltzman that creativity shouldn't be equated with originality and that an S→ R approach can't deal appropriately with creativity.[109]

Since Ray's behavioristic analysis pertains primarily to originality, and not creativity, he feels compelled to define the former as thinking which produces new ideas and to define the latter as thinking which examines existing sets of ideas and conclusions.[110] To clarify, thinking PER SE, is defined by Ray, as the search for a method of change in the solving of a problem (i.e., this search is reasoning);[111] however, once the method is discovered, there is a problem solution.[112] He then proposes an analogy apropos, to what is now being pursued, which he feels is easily understood by all because most people have observed that a given stimulus will

produce different responses depending upon the time variable, for example: A doughnut at 11 A.M. is quite different from a doughnut being given at 12:30 P.M.[113] Similarly, when an individual thinks, he may have a thought which is a response to a previous event; this thought can seemingly become a stimulus for a following event.[114]

What is the point being developed in the preceding paragraph? According to Ray, the fundamental problem in the training for originality and other traits of creativity is the design of methodology to increase trait occurrence in diverse situations, thus permitting reinforcement;[115] consequently, the same principles of conditioning regarding individual behavior (as doughnut eating or the increase of past experience to emit particular thoughts) can increase the expression of an individual trait (say originality);[116] whereby the trait is not only strengthned but also other traits of creativity are strengthened through "transfer."[117]

Ray next introduces "Trial-and-Error" in thinking and attempts to relate this concept to creativity and originality by elucidating upon two of the most widely quoted authors who dealt with creativity and its traits from a common-sense, rational viewpoint, namely:[118] (1) Poincare's description of the manner in which he discovered a mathematical proof; and (2) Ghiselin's "the Creative Process," (1952), which is a collection of statements from outstanding creative scientists, authors, and painters as to how they produced or invented their ideas, pictures, or poems.

The transition from "reinforcement of traits" of creativity to the "Trial-and-Error" theme is seemingly not incongruous fore Tolman, who introduced "mind" into psychology as a complex system, suggested constructs to overcome Watsonian over-simplification in order to generate experimentation,[119] AND also suggested that three levels of learning exist, namely: (1) conditioning (i.e., operant or Skinnerian); (2) trial-in-error; and (3) insight (i.e., characterized by the Gestalt school whereby the whole is more important than the sum of its parts and by the learning of relationships that underlie what is to be learned[120]).

To continue, Ray has two objections to "trial-and-error" thinking (i.e., ideas

arising that are either rejected or accepted) which are: (1) ideas are too easily forgotten; and (2) ideas arising often are not relevant to the topic under consideration.

There were several reasons why this student disagrees with Ray's behavioristic emphasis on thinking. Firstly, this student concurs with L.M. Terman's awareness of the lack of recognition and encouragement of brighter children in American schools.[121]

> Both teachers and parents, it seemed, wanted to produce the conventional, socially well-adjusted child and viewed the unusually talented student with suspicion. Terman's work, together with Leta Hollingworth's (1926) studies of the difficulties of adjustment of very high I-Q children, made a considerable impact;
> - - - But it was the advent of Sputnick in 1957 that shocked America into asking whether its educational system was failing to produce sufficient original scientists to maintain its technological lead in the modern world.[122]

Secondly, this student concurs that another turning point was J.P. Guilford's (1950) paper which pointed out that almost all the tests used by American educationalists and psychologists were "convergent" (i.e., there was one correct answer).[123] The result was a series of investigations pertaining to creative tests, to the recognition of children with unusual ideas, to tolerating and encouraging independent thinking (instead of repressing them because they upset the teacher's routine), to training students to develop their potential creative powers, and finally to select research workers for creativity than for convergent types of achievement.[124] Lastly, this student concurs with the fact that American educational models stem from the British "empiricism" of Hobbes, Locke, and Hume whereby the pragmatic was emphasized and from British "rationalism" represented in Gestalt and cognitive psychology.[125] The American mind, naturally bent toward the pragmatic and empirical, easily adopted the behaviorism of Watson, Skinner, and Thorndike and the functionalism of James, Dewey, and Judd.[126] This "frame of reference" resulted in paradigms, constructs, and models, which to the exclusion of Tolman, the eclectic, dominates American psychology, inhibiting the Gestalt, Cognative, and Group Process approaches to learning. In short, if an idea doesn't "fit" a particular model, it is alienated and classified as unproductive not only on theoretical plane but on a practitioner's plane as well, fore the latter feeds on the former.

Creative thinking from laboratory studies is illustrated keenly by Mednick's definition of it as the forming of associative elements into new combinations;[127] consequently, associations to any one stimulus may be arranged as a flat or steep slope. The figure below illustrates what concepts that he is attempting to proselytize:[128]

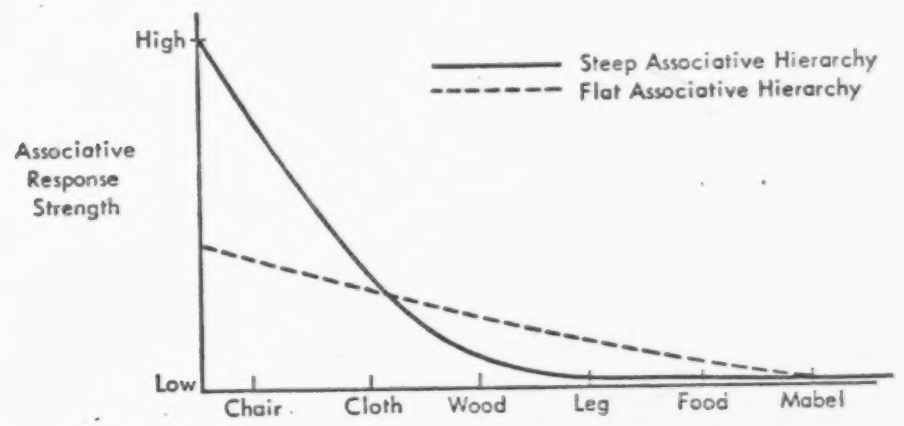


FIGURE 7. Associative hierarchies around the word *table*. (Reproduced by permission of the American Psychological Association and Sarnoff A. Mednick from S. A. Mednick. The Associative Basis of the Creative Process, *Psychol. Rev.*, 1962, 69, 220-232.)

> Such slopes may occur with different stimulus words within the same person, and some persons may have many more of one type than the other. Steep slopes imply that the associative responses appear more rapidly and are more probably the common type than with flat slopes. The man with flat slopes will have more uncommon associations and will be more creative than the man whose slopes are mostly steep. Mednick further assumes that steep slopes are accompanied by a smaller number of associations.[129]

Maltzman, Belloni and Fishbein, however, using their procedure and Mednick's RAT, found no differences between the word-association hierarchies of subjects of high or of low creativity.[130]

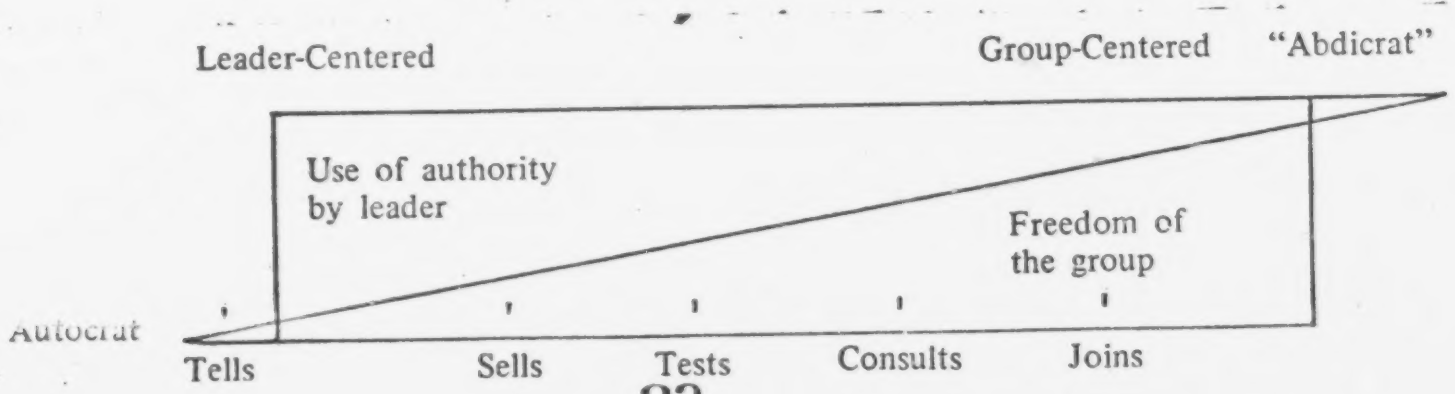
Mednick further believes that the total number of associations which one has to a given stimulus will influence his ability to produce combinations and that "saturation" or massed instructional content when taught within a short time period will produce better problem solutions, namely: ideas in a school class which occur fifteen minutes apart are likely to be better assimilated than if the spacing in time was further apart.[131] Mednick's theory seems feasible; interestingly, his "Remote Association Test" (RAT) which was designed for selecting creative

individuals seems to correlate with the above diagram explanation. This would assume that abstract and concrete concepts are analogous to uncommon and common associations.[132] If research could reinforce, as much as possible, the uncommon and common associations, it might increase the uncommon associations to a higher level of abstraction on a hierarchial scale and also increase the common associations on a longitudinal scale. One or both of these procedures would certainly affect intelligence tests which are predominantly in use.

E.

Creative thinking from non-laboratory studies is illustrated by Mearns (1959) who emphasized that the teacher who can function within the framework of the untraditional can facilitate student creativity through reinforcement, approval, and original effort.[133] His study is reinforced by Carl R. Rogers, et al.[134] In short, the teacher is advised to wait for the appearance of original and creative behavior, fostered by a "permissive atmosphere," the absence of "drill," or "excessive discipline;"[135] then, according to Mearns, original and creative behavior eventually appear because all normal children have an urge to create.[136] The learning situation can be considerably enhanced if a videotape play-back occurs because students have a habit of reacting to themselves (the primary disadvantage however of the videotape is its high cost as compared with the cost of tape recorder).[137] Make no mistake about the fact, however, that this type of class procedure can't be traumatic to the newly initiated instructor, no matter how committed to fresh approaches he may be.

No matter how democratic or authoritarian a teacher is able to allow himself to be, the following "classic" paradigm of Warren Schmidt and Robert Tannebaum seems to hold true:[138]



The autocrat violates THE traditional and self concept; the abdicrat violates the concepts of leadership which gets work done. It is within the rectangle that the freedom of the group is maximized so that divergent thinking can take place. In short, course content can be achieved with Tannebaum and Schmidt's paradigm, in this student's opinion because it facilitates student dialogue (not monologue), facilitates outside reading, supplies feedback of class presentations, and emphasizes socialization. In short, it is a fine instrument for evaluation (i.e., environmental; peers and teacher; and personal) of divergent thinking, in addition to enhancing the satisfaction of the higher needs of Maslow's "Hierarchy of Needs."[139]

Creative thinking in non-laboratory work reveals that men, like Maltzman, Mednick, and Guilford, have multitudinous suggestions as to the nature of creativity and to how it was produced in the laboratory situation but do not point out as to how an individual aids his colleagues toward more originality and creativity in daily life.[140] Two systems to enhance practical creativity have arisen as a consequence;[141] both have been accepted by industry, business, and the U.S. Military Academy as evidence of their possible usefulness.[142] Osborn's (1957) "brainstorming" technique and Gordon's (1961) "synectics" are the two techniques involved.[143]

"Brainstorming" consists of having five to ten individuals gathering together, questioning a topic, giving of participant answers about the topic (the answers being written on a blackborad), the theory being that socialization is facilitated and that participants are stimulated to think of more topical answers.[144] The only two rules which participants must follow are that they can't criticize and that quantity, not quality, of ideas expressed are important.[145] Evaluation of answers is done at a separate time, sometimes by a foreign party.[146]

"Synectics" is similar but also different. It requires work in groups and is defined as a mental activity in problem solving whereby artistic and technical inventions hopefully result.[147]

Ray's objection to these two techniques is that they lack participant strategies

which posesthe question as to whether the methodology might not be more efficient 'if participants developed individual methods of expression at frequent time intervals.[148] This student disagrees because group and individual spontaneity would seem to be lost resulting in a possible diminishing of quantity of answers to the topic and in the de-emphasizing of the group processes as:[149]

(1) structure - Order imposed on course content by group psychological and social forces.

(2) authority relations - Is leadership which each participant can assume to the extent that the institutionally designated leader performs his group task roles, establishes appropriate emotional group relations, and establishes his appropriate status in the group.

(3) group norms - A social system automatically develops when groups are formed so that groups have their unique goals, expectations, and modes of behavior.

(4) power relationships - It comprises the ability of one or more persons which influence the behavior of another. Being neither good nor bad, it simply means persuasion is sought, not coersion.

(5) emotional modalities - Are processes occurring within the learner which influences his absorption of course content (i.e., such as selective inattention, rejection or distortion of new learnings which disrupt his present cognitive organization, etc.).

(6) group culture - It means that acceptable ways of expressing emotion, getting support for opinion and the giving of feedback become stabilized and predictable as interaction takes place [illegible] and grows.

(7) conflict dynamics - This process characterizes two societal developments of the group's social system. These are: (a) attempts by learner to meet individual needs; and (b) attempts by the instructors and learners to establish group standards and social relationships for achieving the educational goals of the group. These two processes conflict at the beginning of any group gathering as illustrated in the previous paradigm

of Schmidt and Tannebaum on page 21. As the group gets acquainted, the conflict hopefully becomes minimal.

In what manner can thinkers express individual differences according to the "trial and error" model? These individual differences express themselves in the accuracy and detail of interpretation of the external world, in manipulations of its interpretative elements, in selective criteria, and in the number and range of variations in thought trials produced (i.e., the more numerous and varied such trials, the greater chance for success).[150]

> The value of wide ranging variation in thought trials is of course vitiated if there is not the precise application of the selective criterion which weeds out the overwhelming bulk of inadequate trials. This editing talent undoubtedly differs widely from person to person as Poincare (1913) has emphasized.[151]

It should be noted that much creative thought is opportunistic resulting in a wide number of selective criteria available at all times against which thought trials are judged. The more creative thinker may be able to keep in mind more such criteria resulting in an increase of his ability to make desirable discoveries by accident on a problem tangential to his initial endeavor.[152] To conclude, further areas of individual differences lie in the competence of retention, cumulation, and transmission of encountered solutions.[153]

F.

The fundamental rationale for emphasizing creative test scores and experimental research, up to this point, is because this student believes test-scores and experimental research have a stronger base and brighter future for identifying creative thinking; however, since the critical issue underlying all work in the field of educational creativity is the criterion problem[154] (i.e., appropriate index of creativity[155]), four additional common criteria will be enumerated, namely:

(1) achievement - Is an attempt to identify famous achievements of individuals, the achievement being taken as an index for creativity that few would dispute (Ghiselin, 1952).[156]

(2) rating - Is essentially the evaluation by peers, teachers, and supervisors (MacKinnon, 1964; Drevdahl, 1964).[157]

(3) intelligence - It essentially means that a superior I.Q. infers superior creativity being that creativity is a mental function (Terman, 1925)[158]

(4) personality - It means characteristics of personality are evaluated in relation to an empirically derived profile of the "creative personality," and the closeness of the "fit" is used as a criterion (Cattell and Drevdahl , 1955).[159]

G.

Personality assessment is still flourishing, despite the pronouncement of its failure by Cronbach (1956).[160] The necessity of establishing personality measurement was well understood in 1948 when the OSS Assessment Staff published Assessment of Men.[161] Essentially, the publication was a program of psychological procedures which evaluated the capabilities of individuals to serve over-seas in the activities of irregular warfare carried out by the U.S. Office of Strategic Services during World War II.[162] Interestingly, the program was, for all practical purposes, based upon the German military psychologist, Simoneit (1940).[163] It involved the multiple testing and observing of individuals in a group setting, a pooling of test scores and subjective observations by trained observers, a prediction of the subject's behavior in certain types of role and situation, an attempt to delineate the personality as a whole, a concern with the "positive" aspects of personality and its potentialities for effective functioning, and, finally, a serious attempt to validate the predictions of future behavior.[164] This program seems understandably crude regarding criteria; however, similar assessment is still being used, the opinion being based upon observation of employment interviewers and upon readings similar to Walkup (1971)[165]; by contrast, Torrance designed two brief screening devices for studying the creative personality, the "Creative Motivation Checklist" (which consistently differentiated

the creative from the less creative with only thirty items) and the "What Kind of Person Are You?" test (which takes most subjects 5 to 10 minutes to complete).[166] Since immediate feedback is obtained, both tests are ideal for use in teaching, in experimental grouping sessions, and in audience-involving discussions of the creative person and of creative behavior.[167] The point which was attempted to be made was that measurement of personality in 1948 was crude compared to the Creative Motivation Checklist of 1958; however, critics of continued research of creativity do exist. Their objections can not be taken too lightly.

Treffinger, Rensulli, and Feldhusen feel that the failure of research to master certain basic problems of creative thinking after twenty years of intensive study has led to a decrease in interest among educational practitioners.[168] This statement overlooks the tremendous surge of research and practitioner energy directed towards creativity as evident in APPENDIX B. In addition, E.P. Torrance has received 4000 letters of inquiry per year during the last five years from investigators desiring to use Torrance's tests of creative thinking, other original instruments used in studying creative behavior, or instructional materials developed by Torrance and associates.[169] The inquiries came from every state in the union; surprisingly, a random sample of the 4000 inquiries revealed that a certain percentage came from thirty-six foreign countries.[170] A Richardson Foundation grant enabled Torrance to correspond and to grant permission for the use of some of the tests and materials requested resulting in the doubling of publications and reports on creativity throughout the nation.[171]

Even though Treffinger and associates do assume that creativity exists and that it is multidimensional in nature, they point out that no single, widely accepted theory of creativity exists which can make possible an "adequate" measurement of creative thinking.[172] Treffinger and associates might have overlooked the fact that creativity is not distinct from intelligence and that intelligence comprises many abilities to be used for different purposes, especially within the categories of divergent

thinking and transformation as represented in Guilford's "structure of intellect" model.[173] If we were to consider that there are 24 divergent production abilities in the divergent thinking category of the SI model and if 23 of the 24 have been identified by factor analysis,[174] then, surely, these 23 abilities are fact not theory. If the many abilities of cognition, memory, divergent thinking, convergent thinking, and evaluation are constantly being used in research studies because they have been identified through factor analysis,[175] Treffinger and associates seem to hold a precarious position. Treffinger and associates further pursue Guilford by emphasizing that a comprehensive theory of creativity would comprise non-cognitive components as well as cognitive. Guilford seems aware of this. For example, validity and factorial composition can't be taken for granted because ratings are as questionable as criteria unless obtained from experienced observers making observations under <u>controlled conditions.</u>[176] For example, if a group of engineers were given a problem and told to be creative in their approach to a problem, the test results would reveal a higher quality of workmenship than a matched group who were told merely to solve a certain problem (i.e., the production of the two groups, however, would not vary).[177]

Treffinger and associates accuse Torrance of being eclectic in approach, of lacking a unified, comprehensive,theorical base, and of using the variables (i.e., fluency, flexibility, originality, and elaboration) existing in Guilford's paradigm.[178] The first and third accusations seem superficial because the purpose of experimental research is to generate future research through operational definitions. Torrance's former occupation before entering educational research also might explain his eclecticism; he formerly was a college counselor.[179] The second accusation however seems characteristic of the field of educational research but it doesn't warrant the conclusion that educators are confronted with the following difficulties as a result of not having a unified, comprehensive theoretical base, such as: establishing useful operational definitions, understanding the

implications of differences among tests and test administration procedures, and understanding the relationships of creativity to other human abilities.[180] The IMPACT program, creative project center, Guilford's SI model, and Torrance's energies directed toward rewarding creative behavior seem to contradict the previous sentence. One might easily infer that Treffinger, Rensulli, and Feldhusen's battle was not with the theoretical base of creativity but with the rate of theory building in general.

Regarding criteria of measurement, Treffinger and associates become more positive. To quote:

> While divergent-thinking measures certainly do not tell the entire story about creativity, it is quite likely that these measures do assess intellectual abilities which play an important role in creativity.[181]

The reader by now is aware that creativity is not a single variable but is he confident that tests of divergent-thinking abilities have validity?[182] For example, the Wallack-Kogan "creativity" scores do tell us the amount of concepts the subject has in his memory store![183] The scores therefore represent cognition abilites; since cognition abilities are dependent upon concept storage, the IQ test predominantly measures "structure of intellect" cognitive abilities.[184] In addition, one needs to be careful regarding any test which is claimed to be a test of creativity, even though it SEEMS to fit a plausible theory concerning that concept (i.e., the best kind of empiricle check is to factor analyze the test, with appropriate controls).[185]

To conclude, this report will enumerate four basic problems pertaining to creativity which became evident from an analysis of 300 collected reports, abstracts, and journals originating in a variety of universities, colleges, and research organizations:[186] (1) the validity of the tests of creative thinking, (2) the relationship between creative thinking ability and intelligence, (3) the relationship between creative thinking and school achievement as measured by standardized achievement tests and by teacher grades, and (4) the facilitation of creative development through specific kinds of educational experience.

7. Summary:

A. Conclusions:

(1) There is no one definition or one measurement of creativity because, like intelligence from which it can not be separated, it is multi-dimensional, or complex. For example, intelligence is composed of many abilities and creative performance draws upon a very large amount of these intellectual abilities for different purposes, especially the categories of divergent-thinking and transformation in the SI model (i.e., Guilford's "Structure of Intellect" model).[187]

(2) Creative Thinking is inextricably involved with divergent production (i.e., a variety of output from the same source, reflecting the use of innovation, originality, and unusual synthesis);[188] however, divergent production abilities are not the only abilities that make significant contributions to creative output (i.e., this becomes more true as we broaden our interest to problem solving).[189] To illustrate: If one were planning a program of training, his efforts at assessment of the program's success might prove a failure because the selected abilities desired were assessed by tests not weighted with the instructional material of the instructor.[190] The cause for assessment failure was then the careless selection of tests for products of units and classes which had no relationship to the kinds of problems in the exam.[191] Efforts for assessment would have been successful if the chosen tests for products of transformation and implication were used.[192]

(3) It has been generally recognized, regarding the SI model that the role of fluency thinking (i.e., see page 9) as represented by divergent-production in its various forms has caused the neglect to study abilities related to creativity in the other operation categories (i.e., evaluation, memory, and cognition) in general and especially the product categories of transformations and implications in particular.[193]

The category of transformations has twenty abilities of which sixteen lie outside the divergent-production column. Interestingly, it is rated higher than the divergent production abilities by the scientists. HOWEVER, THE ABILITY RATED HIGHEST LIES IN BOTH CATEGORIES; IT CONSISTS OF THE DIVERGENT PRODUCTION OF TRANSFORMS.[194] Recent Aptitude Project studies have found that high school learning and memory for factual information are dependent upon cognition for semantic transformations and memory for semantic transformations.[195] In short, students who are ready to revise their conceptions as they read and who remember them, carry away more information from what they read.[196] Also, solving a problem may depend upon revisions in one's conception of the problem and this changing of one's conception is dependent upon the cognition of transformations.[197] In addition, "sensitivity to problems" (or being aware problems exist) is an aptitude for creativity (as validated by factor analysis in 1950) and recently has been identified as cognition of semantic implications.[198] There are four of such abilities for the four content areas, and the ability of most importance depends upon whether it pertains to concrete objects, symbolic information (as in math), or to interpersonal relations.[199]

One other category which has been neglected is evaluation, a needed study for improving creativity (i.e., the creative solver hasn't finished his job without applying it).[200] A good example of evaluation would be Osborn's brainstorming method which provides for evaluative and idea producing sessions, the rationale being that deferred judgement needs the separation of the two functions in order to provide greater flow of ideas during the idea generating period.[201]

Memory is another neglected category in the SI model but it is conceptualized as an act of putting information into memory storage.[202]

Assuming much of memory storage is temporary, the assumption can not be used as an excuse to not practice and exercise retrieval skills.[203]

If educationalists want to produce skilled problem solvers, the student must encounter experiences which EXERCISE the abilities in ALL categories, inferring that a broad curriculum is a necessity, that content has relevancy, and that the learner gets acquainted to exercise his abilities in the different categories in order to make the SI model meaningful and also effective for generalization of skills within the categories (i.e., transfer of skills).[204]

This sort of program would necessitate provisions being made for individual instruction, individual rates of progress (a task not to difficult to imagine in this computer age), and the teaching of classroom strategies, such as attribute listing, deferred judgement, checklist methods, linguistic studies, etc.[205]

To conclude, the student must be reminded that memory storage is an absolute requirement for CREATIVE PROBLEM SOLVING.[206] Information, indeed, is the substance of intellectual functioning.

(4) There are levels of creativity, namely: independent expression; artistic or scientific products; inventiveness and modification of conceptualizing skills.[207] If the individual senses incompleteness, it results in a tension which is sought to be relieved.[208]

(5) Among educators creative thinking is either threatening or a force to be encouraged for lifting the student to higher levels of functioning regarding mental health, educational achievement, vocational success, and many other important areas of life.[209]

(5) The creative person whose ideas are ignored or rejected should be protected until he can work them out and make them productive. This was found true not only in children but in a study of creative engineers.[210]

(7) J.P. Guilford's "Structure of Intellect" model has been factorially analyzed resulting in appropriate tests for the significant measurement of creativity. Since the creative process is multi-dimensional in nature, Guilford's approach to it was to identify as many abilities in the SI model categories as possible. This he has done immensurably well.

(8) E.Paul Torrance has done remarkable measuring of creativity with his "Minnesota Tests for Creative Thinking;" however, his tests do not measure the spectrum of creativity which the SI model is able to do.

The materials which he has developed seem impressive, namely:

(a) His Imagi/Craft materials consist of a set of ten record albums with teacher guides. Their goal is to aid children in learning about the creative process and to engage c hildren in creative thinking experiences.[211] The initial large-scale field test of these materials has been described in an U.S. Office of Education report.[212]

(b) His Idea Books are a second set of materials which have been used in a variety of classroom experiments in the intermediate grades and which have resulted in creative growth as assessed by the "Minnesota Tests of Creative Thinking."[213] Both the Imagi/Craft and Idea Books were designed to be related to various aspects of the elementary and junior high school curriculum and to aid integration within various aspects of the curriculum in the minds of the pupils.[214] In addition teacher guides were designed to help teachers give the necessary guidance.[215]

(c) A third set of materials is designed in teaching upper elementary pupils some of the concepts and skills of DOING CREATIVE RESEARCH;[216] although successful when used by skilled

teachers, they haven't had the circulation of the previous two sets.[217]

(d) A fourth set of materials were designed by Torrance for in-service workshops and other kinds of training programs.[218] The most widely available set of materials is the series of ten "Classroom Creativity" articles prepared for the Instructor magazine in 1964-5.[219]

(9) A high IQ in children is not related to high creative thinking,[220] one reason being that IQ tests are predominantly measures of cognition abilities.[221]

(10) Tests of divergent thinking have significant validity.[222]

(11) When SI model abilities are proved valid by factor analysis, they are fact not theory.[223]

B. Criticisms:

(1) External:

a. Strategy of an experimental study wasn't followed, particularly in regard to internal and external validity.

b. The study depended too heavily upon cited material from secondary sources.

c. The writer didn't seek criticism of certain statements from competent experts.

d. There are but a few experts on the measurement of creative thinking (i.e., serious criticism demands a multitude of modern skills to validate or invalidate any problem or hypotheses concerning the measurement of creativity).

(2) Internal:

a. This report attempted to follow the Work Plan of this study and to exercise vigilance regarding "degree of integration" and

"design appropriateness."

b. Misinterpretation or incongruities of the covered material were unintentional.

C. Limitations of Findings:

(1) This report follows in total neither historical nor experimental strategy; in short, it tends to itemize and to become an overview.

(2) The report relies too heavily on Guilford, Torrance and Ray; this, perhaps, would reveal an unintentional bias.

D. Strengths of Study:

(1) An attempt was made to make the report orderly, having continuity of thought and appropriateness for the framework of course reference.

(2) It would seem that the Problem was sufficiently covered and answered.

(3) Essentially, historical strategy was used so that the practitioner might better grasp the experimental issues; this was hopefully achieved through the minimal use of experimental terminology.

(4) Guilford's "Structure of Intellect" model seems to be an appropriate tool for measurement of creativity on a wide spectrum; Torrance's battery of tests seem equally valid but focus upon a more narrow spectrum of creativity.

E. Implications for Future Research:

(1) Since this student assumes that many abilities related to creativity can now be measured, abilities of the following neglected categories should further be identified and studied, namely: evaluation, memory, transformations, and implications.

(2) Development of a unified, comprehensive, theoretical base for the use of generating operational concepts.

(3) Development of more and better materials for creativity.

(4) Development of more and better teachers skilled at using available materials and tests of creativity.

(5) Development of teachers who are knowledgeable with the SI model and who can train pupils to be equally knowledgeable for the pupils' maximum use of his abilities.

(6) Development of curricula based upon the SI model.

(7) Development of pupils from the ninth to the twelfth grade to be knowledgeable of research procedures and testings.

(8) Dissemination of literature regarding the following: (a) the validity of the tests of creative thinking, (b) the relationship between creative thinking ability and intelligence, (c) the relationship between creative thinking and school achievement as measured by standardized achievement tests and by teacher grades, and (d) the facilitation of creative development through specific kinds of educational experiences.

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APPENDIX A

A. Commercially available instruments useful in studying creative behavior:

1. Verbal Ability:

a. Associative Fluency 1 (AF), by Christensen and Guilford. The task is to list as many words as possible that bear a specified, meaningful relation to the stimulus words. The forms are equivalent. Jr. high school through college and adult levels. Available from Sheridan Psychological Services, Inc., P.O. Box 837, Beverly Hills, California 90213.

b. Consequences (CQ) by Christensen, Merrifield and Guilford. A measure of two factors: ideational fluency (divergent production of semantic units) and originality (divergent production of sementic transformations). Provides a score for each factor. Jr. high school through college and adult levels. Available from Sheridan Psychological Services, Inc.

c. Torrance Tests of Creativity with Words (Forms A & B), by E.P. Torrance. Contain seven sub-tests which require the individual to (a) ask questions about an unusual picture, (b) guess causes of the action in the pictures, (c) guess consequences of the action in the picture, (d) think of ideas for improving a stuffed toy monkey or elephant, (e) list unusual uses for cardboard boxes or tin cans, and (f) predict consequences of an improbable event. Available from Personnel Press, 191 Spring St., Lexington, Mass. 02173.

2. Non-Verbal Ability:

a. Torrance Tests of Thinking Creatively with Pictures (Forms A&B), by E.P. Torrance. Contains three subtests which require individual to draw pictures which elaborate upon (a) a singly brightly colored form, (b) ten imcomplete line drawings, and (c) thirty-six identical circles (or pairs of parallel lines). Available from the Personnel Press.

3. There are more tests in this article, including not only those which cover "verbal" and "non-verbal" abilities, but those covering "personality" as the

Study of Values (AVL), by H.G. Allport, P.E. Vernon, and G. Lindzey, and the California Psychological Inventory (CPI) by H.G. Gough, and "biographical data" as the Alpha Biographical Inventory and the Biographical Inventory by C.E. Shaefer .

B. Instruments for noncommercial availability useful for studying creative behavior are listed by Gary A. Davis in his article, "Instruments Useful in Studying Creative Behavior and Creative Talent, "Journal of Creative Behavior, 5:161, 3rd quarter, 1971. Davis selected these tests from the monographic list by Gary Davis, It's Your Imagination: Theory and Training of Problem-Solving, scheduled for publication in the spring of 1972, by Basic Books, Incorporated.

APPENDIX B

PARTIAL CONDENSATION OF J.P. GUILFORD'S ARTICLE, "CREATIVITY: RETROSPECT AND PROSPECT," JOURNAL OF CREATIVE BEHAVIOR, 4:149, Summer, 1970.

Prior to 1950, Galton's 19th century study of hereditary genius could be considered the first notable contribution to the empiricle investigation of creative production. Wallas' model of "steps", regarded as creative processes, was the next significant development and seemed to be the result of philosophical speculation and a few publications pertaining to creativity in his day. Catherine Patrick subjected the Wallas' model to some experimental examination in the latter 1930's, while J. Rossman adopted a model similar to that of Wallas after studying the performance of American inventors. At the same time, a few psychometric ---- --- psychologists designed an insignificant number of tests for inventiveness and originality; however, these tests correlated extremely low with tests using scales for assessment of intelligence. Harvey C. Lehman was the next neophyte, studying the biographies of productive people in order to determine the relations of quality and quantity of creative adult output.

During the 1950's, an explosive energy developed to investigate creativity which hasn't stopped,but seems to be blossoming. For example, the amount of psychological publications devoted to creativity by five-year intervals from 1950 to 1965 are as follows: 43 in 1950; 53 in 1955; 177 in 1960; and 471 in 1965.

Project centers, past and present, for research pertaining to creativity since 1950 are too numerous to mention but the interested student should be aware of some of the more important ones, namely:

1. Aptitudes Research Project at the University of Southern California - By its efforts through men like Guilford and Terman, it was able to pursue its primary goal in attempting to understand human intelligence; naturally, the thinking process of individuals, when in the act of creative production, was included, bringing creativity within the realm of intelligence and emphasizing that mental functions of creative thinkers are shared to some

degree by all mankind.

2. Institute for Personality Research and Assessment at the University of California (Berkeley) under Donald W. MacKinnon and Frank Barrow — Its primary goal was to determine what traits can be recognized in creative producers in the general population and in leaders within areas of writing, architecture, administration, and mathematics (not excluding individual differences).

3. University of Minnesota's School of Educational Research - Under E.P. Torrance's directorship of Minnesota's Bureau of Educational Research, a vigorous program was focused on creative qualities and performances of children and of teachers who desired to teach creative thinking. Torrance, presently at the University of Georgia, produced the "Minnesota Test of Creative Thinking."

4. J.W. Getzels and P.W. Jackson's Research at the University of Chicago - Their finding that high IQ in CHILDREN has small relation to aptitude for creativity is generally supported by others.

5. Calvin W. Taylor's Conferences initiated at the University of Utah - His efforts through this tool contributes significantly to continued interest in creativity and research (i.e., five books have resulted from these conferences). The first conference was held in 1955; the latest is being held in Buffalo of this year. Taylor and associates have developed a biographical inventory for indicating creative promise in the sciences. The instrument seems to have usefulness beyond that area.

6. Creative Education Foundation and the Creative Problem - Solving Institute - Both agencies were founded under the sponsorship of Alex F. Osborn, author of Applied Imagination. Both agencies had great impact on research and on interest regarding creativity; this is illustrated in the facts that the Creative Problem-Solving Institute had already its 16th annual meeting and that the Foundation has established the Journal of Creative Behavior, the only periodical devoted exclusively to creativity.

7. Dow Chemical Company - Joseph H. McPherson has expressed much attention to climates conducive to creative output in an industrial setting.

8. The Richardson Foundation of Greenville, N.C.- This foundation not only has supported research on creativity but has established the Richardson Creativity Award which is administered by the American Psychological Foundation.

As a result of the above project centers, and in accordance with the objectives of the Creative Education Foundation, educators are taking the initiative to find ways in which to teach more creatively and to see that learners have opportunities to develop their creative talent. To illustrate: Frank E. Williams' book, Classroom Ideas for Encouraging Thinking and Feeling, applies a taxonomy of teaching strategies in a systematic way to large numbers of classroom events. His book may set a whole new pattern for teacher training.

Most interesting is the fact that the U.S. Office of Education, under Title III, a public law of the federal government, has been supporting a number of centers designed for the cultivation of creative behavior. For example, a program entitled IMPACT which is existing in Polk County, Iowa, trains teachers to think and to teach creatively. IMPACT has resulted in more student productive thinking and self-confidence (as reported by an experimental observer, Norma Trowbridge).